



Energy Programs Office

FMS Division Director Gail Stine

FMS Deputy Division Director Mike Dunn

Utilities Manager John Daum

Engineering Manager Greg Jonas

Fleet Manager John Surdey

Energy Technology Specialist Jim Heine

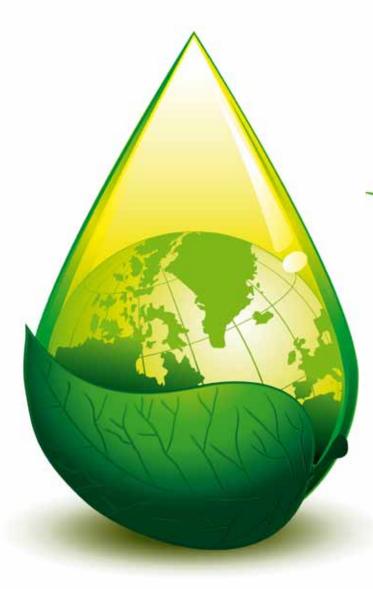
LEED Program Manager George Norek

Energy Program/Project Manager Mark Boehlen

Senior Energy Engineer Dan Ristic

Energy Savings Measurement & Verification Damian Dockery

Outreach Jeff Alicz



Overview

FY 2009 ushered in a new era of energy awareness in the United States. Driven by the run-up in oil prices over the summer of 2008, the change in administration, and the recession, unprecedented levels of funding and effort are being devoted to reshaping America's energy future.

On the programmatic front, Argonne's worldclass researchers are investigating ways to create, store, use, and transmit energy more safely, cleanly, and efficiently. This FY 2009 Energy Report highlights Argonne's operational initiatives to reduce its energy, environmental, and carbon footprints. Not only are the energy conservation measures undertaken the right thing to do, they also help drive down operational costs so that more funding can be directed toward energy research, development, technology, and engineering (RDT&E). Efforts completed this past year included the preliminary design of a new Combined Heat and Power (CHP) plant, the testing of biomass to reduce coal usage at the steam plant, a \$4 million contract to conserve energy at the Advanced Photon Source (APS), and a wide variety of other projects aimed at reducing energy use all across the Argonne campus.



New energy-efficient LED light fixtures



FY 2009 Marks Completion of ESPC-3

Argonne completed its third Super Energy Saving Performance Contract (ESPC-3) during 2009. Under the program's unique method of contracting, verified energy savings pay for the cost of the retrofits over a period of years, so that there are no upfront costs to the Laboratory.

ESPC-3 focused on retrofits in the APS complex. This project involved the installation

of a new cooling tower that provides free cooling to users during cold weather, lighting controls, and modified air handlers for more efficient operation. The ESPC-3 project will save over 32,000 MBtu of energy annually, as well as substantially reduce greenhouse gases and other pollutants. In fact, carbon dioxide emissions will be reduced by more than 11.5 million pounds.

ESPC-3 project cost was approximately \$4 million, with an estimated annual savings of \$464,000 (for a payback of 8.6 years). The three ESPC projects, taken together, are currently yielding energy savings of about \$2 million annually.



Location of new Central Chilled Water plant

New Central Chilled Water Plant to Serve 200 Area

FMS recently conducted a study of future cooling needs for the 200 Area, taking into account several large projects that will add significantly to cooling demand. The study projected significant increases in chilled water demand, amounting to over 8,000 tons within five years; such an increase would far exceed the 4,400-ton capacity of the Laboratory's existing Central Chilled Water (CCW) plant and distribution infrastructure.

To meet this increased demand, a new CCW plant will be built to serve the 200 Area. On completion, this plant, with an area of approximately 22,000 square feet, would add 17,000 tons of chilled water capacity. The benefits offered by the new plant would include replacement of obsolete equipment, elimination of CFC refrigerants, increased energy efficiency, increased capacity to support future loads, increased reliability and redundancy, increased stability of supply water temperature, and reliable low-ambient-temperature operation.

The proposed site for this new facility is in the northwest corner of the 200 Area, on the outside of Outer Circle Road. Design of the new plant is 60% complete and construction is scheduled to begin May 2010.

SAMM Facility Wins Two Energy Awards

In FY 2009, the Laboratory's Sub-Angstrom Microscopy and Microanalysis Facility (SAMM) received a Federal Energy and Water Management Award and a Department of Energy Management Award. These awards recognized Argonne's efforts in designing a facility that was both scientifically cutting-edge and environmentally friendly. The SAMM building is expected to save approximately 1 billion Btu, \$24,100 in energy costs, and 5,700 gallons of water per year.

LEED Certification

LEED (Leadership in Energy and Environmental Design) certification, a professional standardized rating system from the U.S. Green Building Council, is a voluntary, performance-oriented mechanism used to evaluate the design and performance of buildings. Currently, FMS is pursuing (or has already achieved) LEED certification at the following

Argonne-owned facilities:



George Norek, Architect, FMS-Engineering

LEED: New Construction

- · Building 216, SAMM
- Building 440, Center for Nanoscale Materials (CNM)
- CNM, Vibration-Free Facility

LEED: Commercial Interiors

• Building 200, K-wing Fitness Center



Sub-Angstrom Microscopy and Microanalysis Facility (SAMM)



Center for Nanoscale Materials (CNM)



CNM, Vibration-Free Facility



Building 200, K-Wing Fitness Center



CHP Building – North View (conceptual drawing)

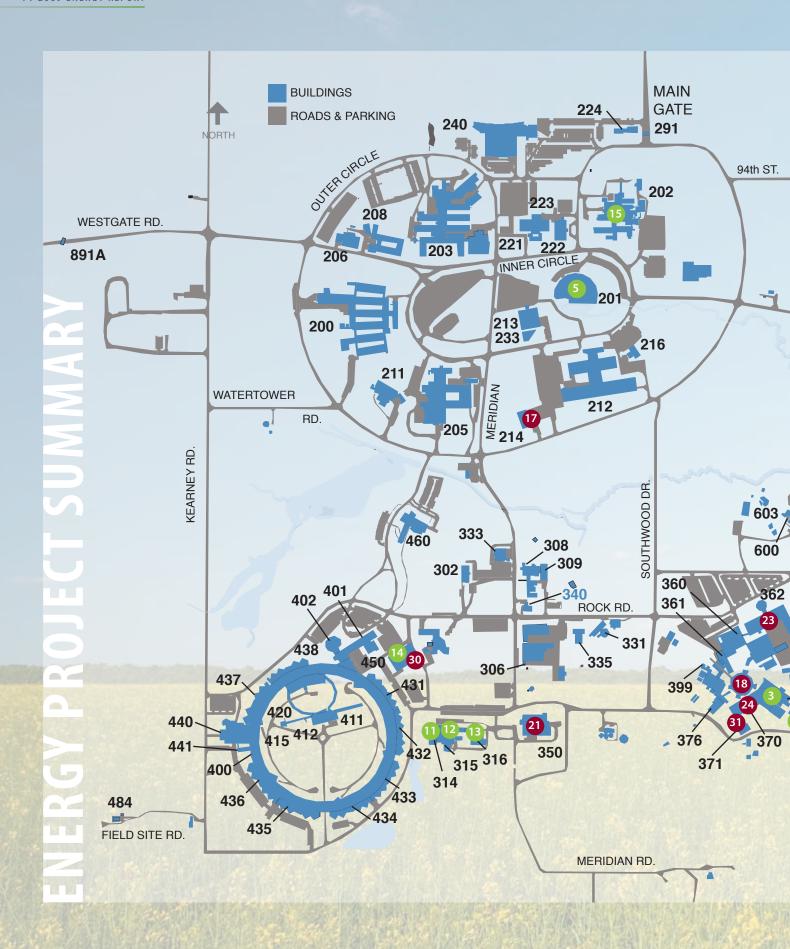
New Combined Heat and Power Plant

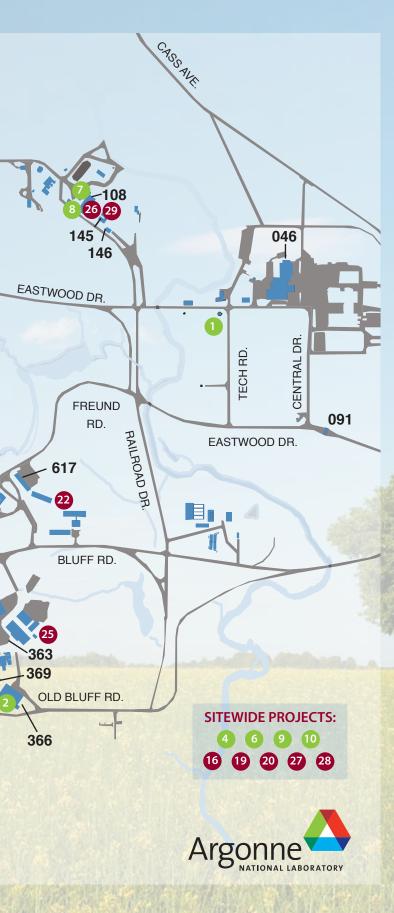
As part of the Steam Plant Life-Cycle Extension project, FMS is currently designing a Combined Heat and Power (CHP) plant, consisting of a gas combustion turbine and a heat recovery steam generator (HRSG), that will produce 6 megawatts of electricity and 110,000 lb/hr of steam. This new CHP plant, with an estimated cost of \$17.6 million, will generate the bulk of the steam needed for the Laboratory (approximately 65%), as well as being able to meet 20% of the site's electric power needs.

The CHP plant will operate 8,592 hours per year, providing a base load of steam (with one week of downtime for maintenance). The HRSG will provide additional steam, either in conjunction with waste heat from the gas combustion turbine or by firing it independently during turbine maintenance periods to enhance operating flexibility.

Advantages provided by the CHP are expected to include the following:

- Increased fuel conversion efficiency
- Lower utility costs
- Lower greenhouse gas emissions
- Lower NOx and SO₂ emissions
- · Increased reliability





FY 2009 COMPLETED ENERGY PROJECTS

- **East Area: Water Tower Heating System Replacement**
- **Building 366: Light Fixture Replacements**
- **Building 369: Light Fixture Replacements**
- Sitewide: Emergency Exit Light Replacements, Phase II
- 5 **Building 201: Condensate Return Repairs**
- 6 Sitewide: ESPC-3, Lighting & HVAC Improvements
- 7 **Building 108: Test Burn of Coal & Wood Biomass**
- 8 **Building 108: Test Burn of Coal & Agricultural Biomass**
- 9 **Sitewide: Water Conservation Audit**
- 10 Sitewide: Survey/Eliminate Steam Trap Losses, Phase I
- 1 **Building 314: Condensate Return Piping Repairs**
- 12 **Building 315: Condensate Return Piping Repairs**
- 13 **Building 316: Condensate Return Piping Repairs**
- 14 **Building 450: Installation of Exterior LED Lights**
- **Building 202: Compressed Air Dryer Replacement**
 - Estimated Annual Energy Savings: 59,625 MBtu/Yr
 - Estimated Annual Energy Cost Savings: \$732,612
 - Estimated Annual Water Savings: 3,463 KGal/Yr
 - Estimated Annual Water Cost Savings: \$6,011

ONGOING ENERGY PROJECTS

- Sitewide: Survey/Eliminate Steam Trap Losses, Phase II
- **Building 214: HVAC Units Replacement**
- **Building 377C: Cooling Tower Modernization**
- Ď Sitewide: Occupancy Sensor Installations
- Sitewide: Emergency Exit Light Replacements, Phase III
- **Building 350: Cooling Tower Replacement**
- **Building 619: Cooling Tower Replacement**
- **Building 362: Light Fixture Replacements**
- **Building 370: Light Fixture Replacements**
- Building 368: Wakefield Experiment Pump Replacement
- Building 108: Boiler Deaerator #2 Replacement (study only)
- Sitewide: High Performance Sustainable Building
- Sitewide: Advanced Metering System (pilot program)
- **Building 108: Steam Valve Replacements**
- **Building 450: Air Compressor Replacements**
- **Building 371D: Chiller Replacement**
 - Estimated Annual Energy Savings: 24,099 MBtu/Yr
 - Estimated Annual Energy Cost Savings: \$315,843
 - Estimated Annual Water Savings: 3,741 KGal/Yr
 - Estimated Annual Water Cost Savings: \$8,230



East Area Water Tower Heating System Installed

The East Area water tower requires a heating system to prevent the water from freezing during the winter season as a result of low usage. Currently, a heating steam line runs 1,500 feet from the Argonne boiler house to heat the tower. Over the years, buildings have been removed from this heating steam line, so that now the line services only the water tower. The length of the pipe run, its deteriorating insulation, and a failed condensate return line have caused substantial water and energy losses.

During FY 2009, FMS conducted a study to determine the payback period associated with installing a small heating boiler next to the tower. The study showed that such a heating system could be expected to save 20,113 MBtu/yr in energy and 2.7 million gal/yr of water. The estimated annual cost savings were calculated at \$177,000, with a payback of approximately two and a half years.

A small package boiler was purchased, installed, and is currently operational, allowing shut down of the inefficient 1,500-foot steam run from the boiler house.





Building 369 Lighting Upgrade Saves Energy, Money

Completed in September 2009, a lighting upgrade in Building 369 has improved the average overall lighting levels from 20 to 52 foot-candles and is expected to save the Laboratory 217,000 kilowatt-hours in energy and well over \$16,000 in annual operating costs.

To achieve these savings, FMS replaced 67 mercury-vapor and 12 incandescent light fixtures with high-output T-5 fluorescent fixtures. In addition, daily operating time for fixtures was reduced from 24 hours to 12 hours on weekdays and zero hours on the weekends by means of a timer. A "holiday override" switch was installed to keep the lighting off during the December holiday shutdown.

Overall project cost (including construction and material costs) is roughly \$58,800; the payback period for the project is estimated to be about three and a half years.



Wood/Coal mixture (foreground) Coal/Ag Pellets mixture (background)

Biomass Test Burns Prove Successful

In FY 2009, FMS embarked on a project to produce steam for the Argonne site in an alternative, energy-efficient, and environmentally friendly manner. The new steam-production method would ultimately involve the co-firing of a biomass and coal mixture, providing an opportunity for the Laboratory to reduce both its consumption of natural gas and its greenhouse gas emissions.

To prove the reliability and safety of the new process, FMS mixed two different types of biomass fuels with coal and burned them in the Laboratory's coal-fired boiler. The tested

fuels comprised wood chips (30% by volume) mixed with coal and agricultural (Ag) pellets (>50% by volume) mixed with coal. The tests were meant to determine (1) whether the biomass fuel would meet all the emissions standards set by the Illinois Environmental Protection Agency and (2) if the existing boiler-house process equipment could handle the new fuel streams (this equipment was originally designed to burn only coal).

Although both biomass fuels posed some minor challenges with respect to their handling, the tests proved successful at the

given biomass percentages. FMS conducted approximately 30 hours of stack emissions sampling on each of the two biomass fuel mixtures to measure various gas pollutants, particulate matter, metals, dioxins, and other components to ensure that the biomass fuel streams burned clean.

Work to be done in FY 2010 includes evaluation of the test burn results, possible testing of new higher-Btu/lb Ag pellets, and further economic analysis.

Argonne Bike Share Program: Good for Fitness, Environment

In 2009, Argonne introduced the Bike Share Program as an alternative transportation program focused on environmentally friendly, healthy alternatives to automobile use on site. While its primary focus is employee wellness, the Bike Share Program also helps save energy and reduce greenhouse gas emissions.

Argonne partnered with the Active Transportation Alliance to develop safety training, required for all program participants. After successful completion of the training, participants were issued helmets and allowed to use any of 100 new bicycles distributed at various locations around the Laboratory. Funds from Argonne's Pollution Prevention Program and energy rebate programs with Commonwealth Edison paid for the bicycles.

Positive outcomes from this program are expected to be sustainable during the coming years:

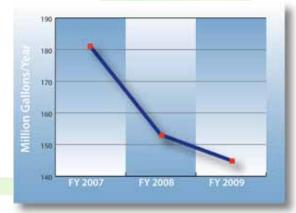
- Estimated reduction of vehicle miles traveled (VMT) per season (67,600 VMT/season);
- Fuel saved is estimated at 5,633 gal/season;
- Dollar savings amount to \$15,490/season; and
- Carbon footprint reduction amounts to 62.78 tons CO₂/season.

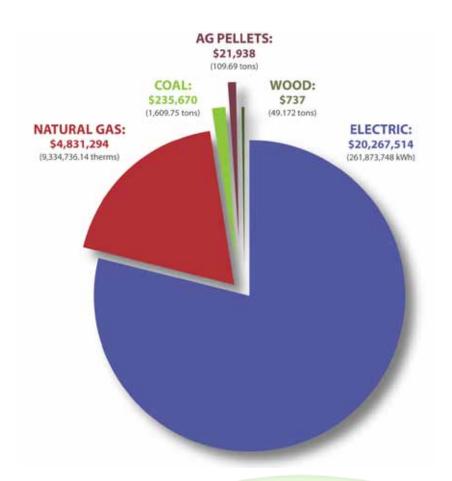




Argonne spends millions of dollars on energy every year to support programmatic and operational needs. Throughout FY 2009, over \$25 million was spent on energy costs and another \$145,000 was used in the purchase of Lake Michigan water. We also continue to experience a steady increase in our use of alternative fuels verses petroleum-based products. The following FY 2009 energy cost graphs show a breakdown of the total energy use and their respective prices.

Lake Michigan WATER Consumption





ENERGY SAVINGS

FY 2004 - FY2010 (est.)



Year-to-Year FUEL Consumption



Diesel consumption reduced due to:

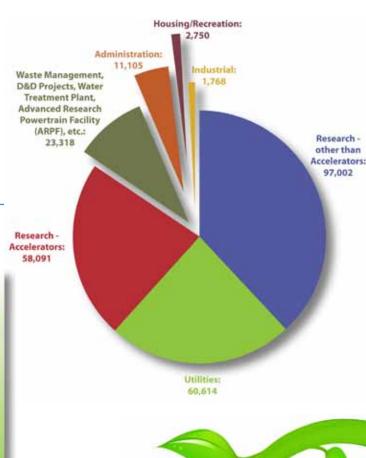
- Newer diesel vehicles with higher fuel economy standards
- Use of ultra low sulfur diesel in all diesel applications

Unleaded gas consumption reduced due to:

- Replacement of a large portion of unleaded operated fleet vehicles with new E-85 operated fleet vehicles
- Replacement of low fuel efficient minivans (~6 miles/gallon) with subcompact sedans (12-13 miles/gallon)
- New division policy of not leaving engines idle while the vehicle is not being operated
- Widespread use of the Argonne Bike Share Program

ELECTRICAL

Consumption per Facilities Groups in FY 2009 (in MWh)



Sitewide ELECTRICAL Consumption





Mike Dunn, FMS Deputy Division Director Argonne National Laboratory 9700 South Cass Avenue Argonne, IL 60439 630.252.3445 mdunn@anl.gov

